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Mg/Ca-paleothermometry in the western Mediterranean Sea on G.bulloides using paleoclimatic record

Boussetta Soumaya (1), Kallel Nejib (1), Bassinot Franck (2), Labeyrie Laurent (2), Duplessy Jean-Claude (2), Caillon Nicolas (2), and Rebaubier Hélène (2)

(1) University of Sfax, FSS, Lab. GEOGLOB, Route de Soukra, BP 802, 3028 Sfax, Tunisia (soumaya.boussetta@lsce.ipsl.fr), (2) LSCE (CEA/CNRS/UVSQ), Domaine du CNRS, Bat 12, Avenue de la Terrasse, 91198 Gif-sur-Yvette, France (franck.Bassinot@lsce.ipsl.fr)

Mg/Ca in foraminiferal calcite has been recently used to estimate past sea surface temperatures (SST) in many oceanic areas. An advantage of this method is that the same biotic carrier can be used for both Mg/Ca and oxygen isotope analyses, which assures a temporal and spatial conformity of the used samples. However, secondary factors affecting shell Mg/Ca, like dissolution, salinity and diagenesis have come into focus. In the Mediterranean Sea, which is characterised by a large surface salinity gradient but a little change in temperature, paleothermometer calibration is not straightforward. By contrast sea surface temperature (SST) reconstructions using foraminiferal associations are reliable. Thus, we tried to establish a downcore Mg/Ca - temperature paleocalibration in the Western Mediterranean Sea.

We have generated a high-resolution Mg/Ca record for the surface-dwelling planktonic foraminifera G.bulloides from the core MD99-2346 collected in the Gulf of Lion and converted Mg/Ca values into temperature using the North Atlantic calibrations. The obtained record, which covers the last 28 000 years, is very similar to that inferred using modern analogue technique applied to fossil foraminiferal assemblages. However, the Mg/Ca-based sea surface temperature estimates are usually several degrees warmer, than those provided by planktonic foraminiferal assemblages indicating a Mg enrichment in the foraminiferal shells of the Mediterranean Sea. Nevertheless, the temperature shift and then the Mg enrichment remain constant along the core. This temperature shift is likely related to the higher salinities of the Mediterranean Sea. When downcore Mg/Ca ratios of G. bulloides are compared with their corresponding micropaleontological SST estimates, we obtain a significant exponential correlation between both proxies (Mg/Ca = 1.20 exp 0.08*SST; R2 = 0.75). This paleocalibration can be used to convert the G. bulloides Mg/Ca values into temperature along the Western Mediterranean cores. These data suggest that down core materials are likely to provide a primary paleotemperature signal and an Mg / Ca-temperature paleocalibration in the Western Mediterranean Sea.